



# GPS III Architecture Study

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# Overview

- What are the study goals?
  - Vision
- What's the study scope?
- How will the studies be conducted?
  - Study organization
  - Interactions and process
  - Products
- Summary



# Vision

Develop approaches for satellite navigation system(s) that capture the positioning, navigation, and timing needs of the Global Positioning System for the next 30 years

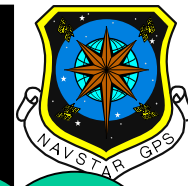


# Study Goals

- Define system architectures for modernizing the Global Positioning System (GPS)
  - Supports Gov't decision on directions for next program phase
  - Addresses Operational Requirements Document **objective** values for positioning, navigation and timing (PNT)
- Develop supporting architecture data
  - Transition/ implementation plans
  - Cost estimates
  - Technical performance estimates



# Study Scope



# GPS Has Many Potential Futures

- Future of the satnav universe is unknown
- Can't pick the "real" GPS III of the future
- Studies define the architecture approaches that best serve several possible futures

? **GPS + incremental upgrades**

? **GPS + WAAS + LAAS**

? **GPS + GMSP + Civil Satnav + Augmentations**



# Desired Characteristics of the Architectures



- Address civil and military ORD objective values for GPS PNT
  - Architecture is an enabler of civil and military PNT
- System-wide, top-down focus
  - Space, Control, User segments; CONOPs; C4I
- Flexibility to evolve over thirty-year lifetime
  - Changing interactions with other satnav systems and GPS augmentations
  - Technology insertion
  - Support to new PNT missions and secondary payloads



# What is NOT in Scope

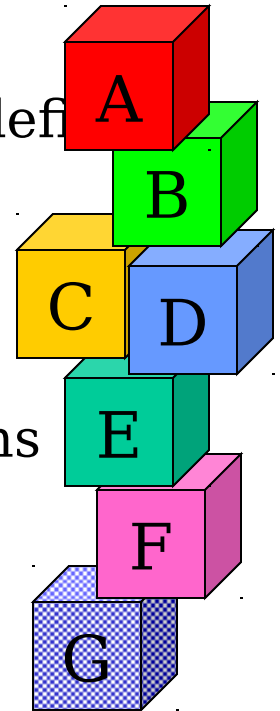
- This isn't an Analysis of Alternatives (AoA)
- This isn't a repeat of the Navwar AoA
  - However, it's results are inputs to your trades
  - Don't revisit Electronic Attack/ Electronic Support
- Gov't team will control some key parameters
  - E.g, signal spectrum decisions: L1, L2, L5, xlink
  - E.g, definitions of Y-code, M-code, L5 signals
- Can't eliminate NUDET Detection System (NDS)
- Don't re-architect other satellite systems
  - However, you may consider inclusion of secondary payloads (civil, military, commercial)





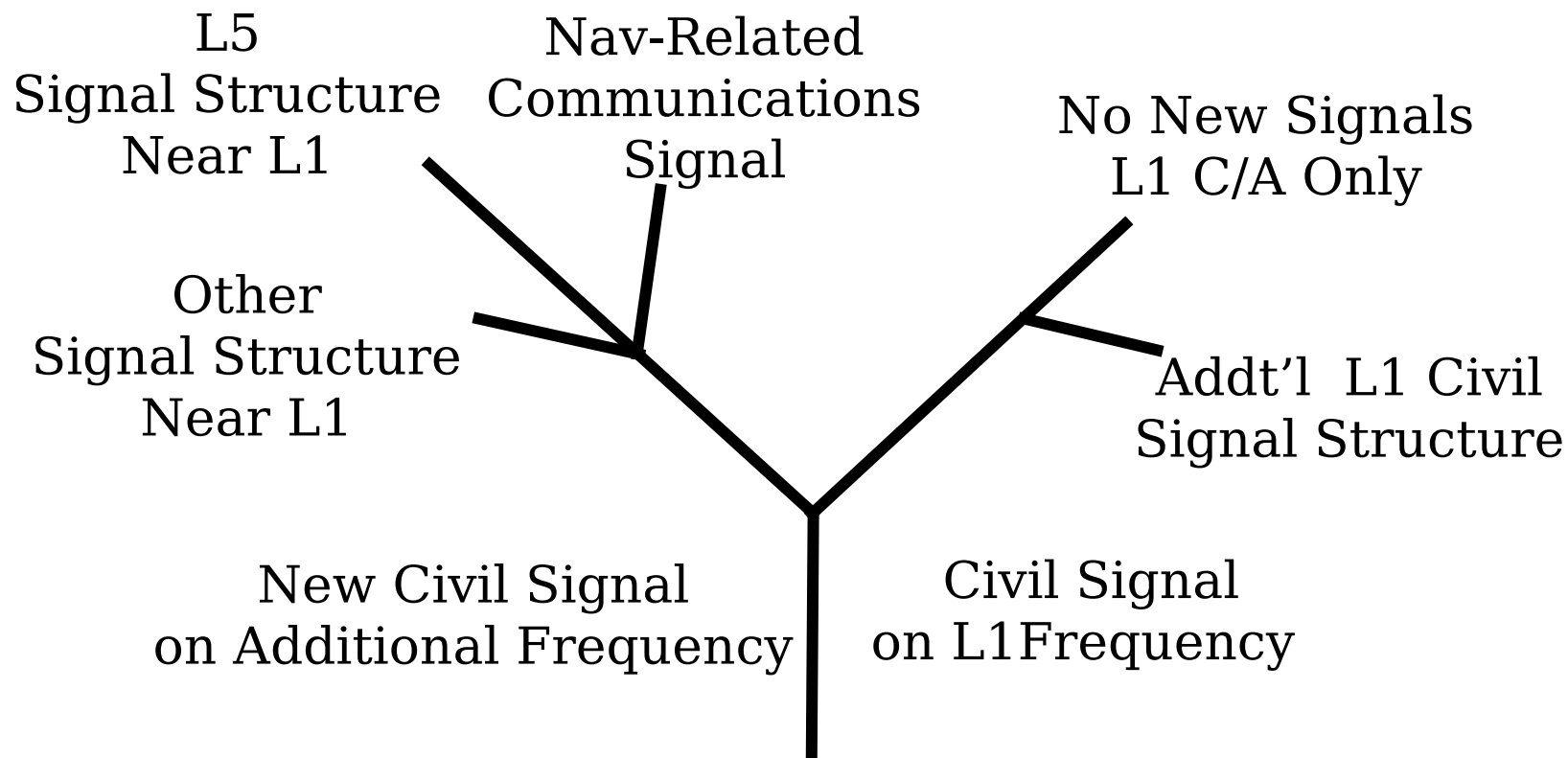
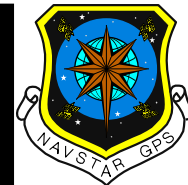
# Technical Trades

- **Technical performance**, e.g.,
  - Submeter accuracy for civil and military
  - Military antijam capability and CONOPs on battlefield
- **Design of system elements**, e.g.,
  - Crosslink architecture and uses
  - Flexible signal generation and radiation
  - Control segment design, elements and operations
  - Potential new signals (nav, comm, NDS)
  - Electronic key management and distribution
- **Constellation design**, e.g.,
  - Satellites, locations, sustainment strategies
  - Relationships with other civil, military, commercial systems





# Example of L1 Civil Signal Options



Unclassified



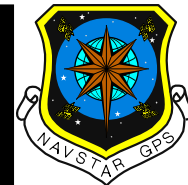
# Functional Trades

- Will use selected key mission areas to represent the wide scope of GPS uses
- Candidate mission areas include:
  - Military missions
    - Precision bombing
    - Mine clearing
    - Situational awareness
  - Civilian missions
    - Precision farming
    - Building/ urban canyon personnel tracking
    - Global Air Traffic Management (GATM)
    - Time synchronization for utilities/ telecommunications



# Augmentation Trades

- Potential Augmentations
  - Pseudolites (air or ground)
  - Global Navigation Satellite System (GNSS)
  - Satellite Based Augmentation Systems (SBAS)
  - Local area differential GPS systems
  - Global Multi-mission Satellite Platform (GMSP)
  - Civil, commercial satnav systems
- Relationships to GPS
  - Enabler of other systems' missions
  - Interoperability



# Alternative Payloads/Missions

- **Communications,**

e.g.,

- Theater communications?
- In-flight retargeting?
- Moving target tracking?
- Blue force tracking?
- NDS space to user

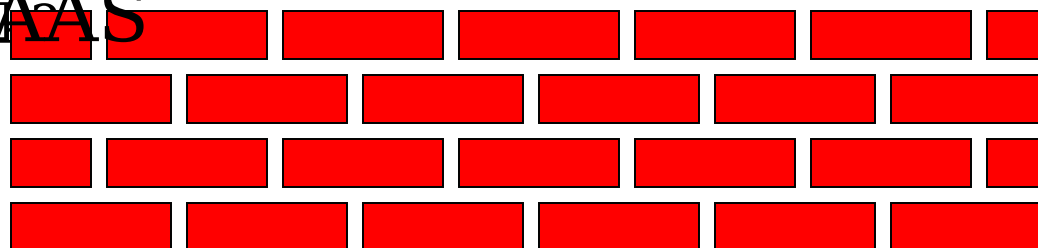
- **Remote sensing,**

e.g.,

- Nuclear detonations?
- Environmental?
- Surveillance?

- **Build on prior studies: GMSP,**

WAA S





# Implementation Trades

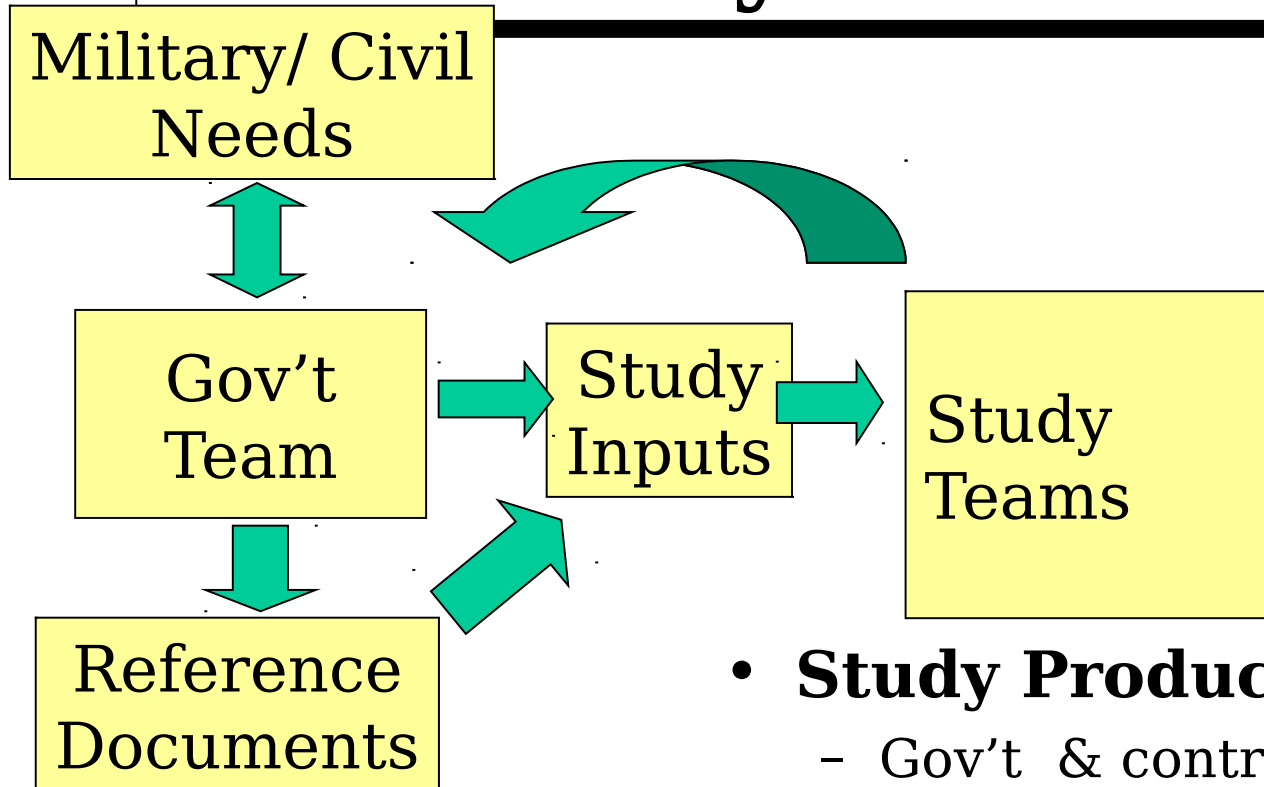
- **At least two architectures**
  - GPS-only
  - GPS as a system of systems (augmentations, satnav systems)
  - Appropriate secondary payloads
- **Transition plan to GPS III architecture**
  - Schedule
  - Launch vehicle and sustainment of PNT
  - Disposition of GPS II assets
- **Benefit versus Risk**
  - Technical
  - Political
  - Cost



# Execution of the Studies



# Study Process



- **Study Products**

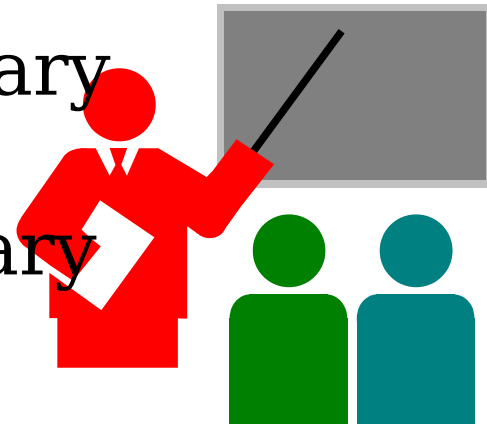
- Gov't & contractor analyses
- Technology, performance & CONOPS assessments
- Decision database
- Architecture definition model
- Gov't cost estimates





# Study Execution

- Gov't team define technical scope & trade space
  - Aerospace & Mitre leads
  - Gov't team will conduct selected studies in parallel
    - Aerospace, Mitre, SETAs, gov't labs
- Technical library of key reference materials will be established
- Contractors may provide proprietary supporting information; however, deliverables must be nonproprietary





# Gov't/ Contractor Interchange



- Government will establish a schedule for formal technical interchanges (ca quarterly)
  - Also periodic informal Q&A and status interchanges by mutual agreement
- Gov't interested in use of electronic conferencing for some technical interchanges\*

\*Contractor capabilities and input

Unclassified

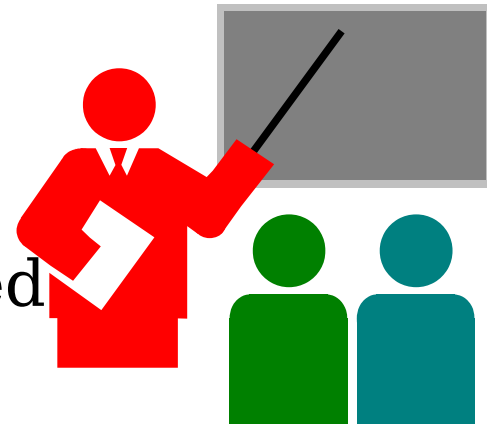


# Study Reporting and Documentation



- Gov't will establish a data repository for study-related communications and reports and findings\*
  - Investigating host environments that protect privileged electronic information (e.g., competition sensitive)
- Gov't investigating documenting findings with system architecture definition tools\*

\*Contractor capabilities and inputs desired





# Security Issues

- Some elements of the study will require access to classified government data up to TS SCI
  - Gov't wishes to understand your ability to conduct work at such levels (personnel, facilities, experience) UP FRONT



# Summary

- Study will focus on satisfying the known near-term needs with an eye to the future
  - Build on existing GPS, GMSP, and augmentations
- Flexibility of the final architecture will be an important feature
  - Can't predict needs for 30 years, so design must be capable of evolving over time
  - Can't satisfy all needs, so GPS must be an **enabler** for allowing other systems to perform